Ecosystem Departure and Fire History Analysis

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Outline

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- Regional sampling scale
- Sampling methods
- Multi-proxy approach

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- Using LANDFIRE for making management decisions
- MNFIs in peatland-forested matrices
- Climate-fire interactions

Summary
- Initial conclusions
- Future work
- Acknowledgements

Project Description

Multi-agency project involving USFS, LANDFIRE, TNC, Michigan Natural Features Inventory, Wisconsin DNR, University of Wisconsin-Madison and Michigan Tech University

Objectives

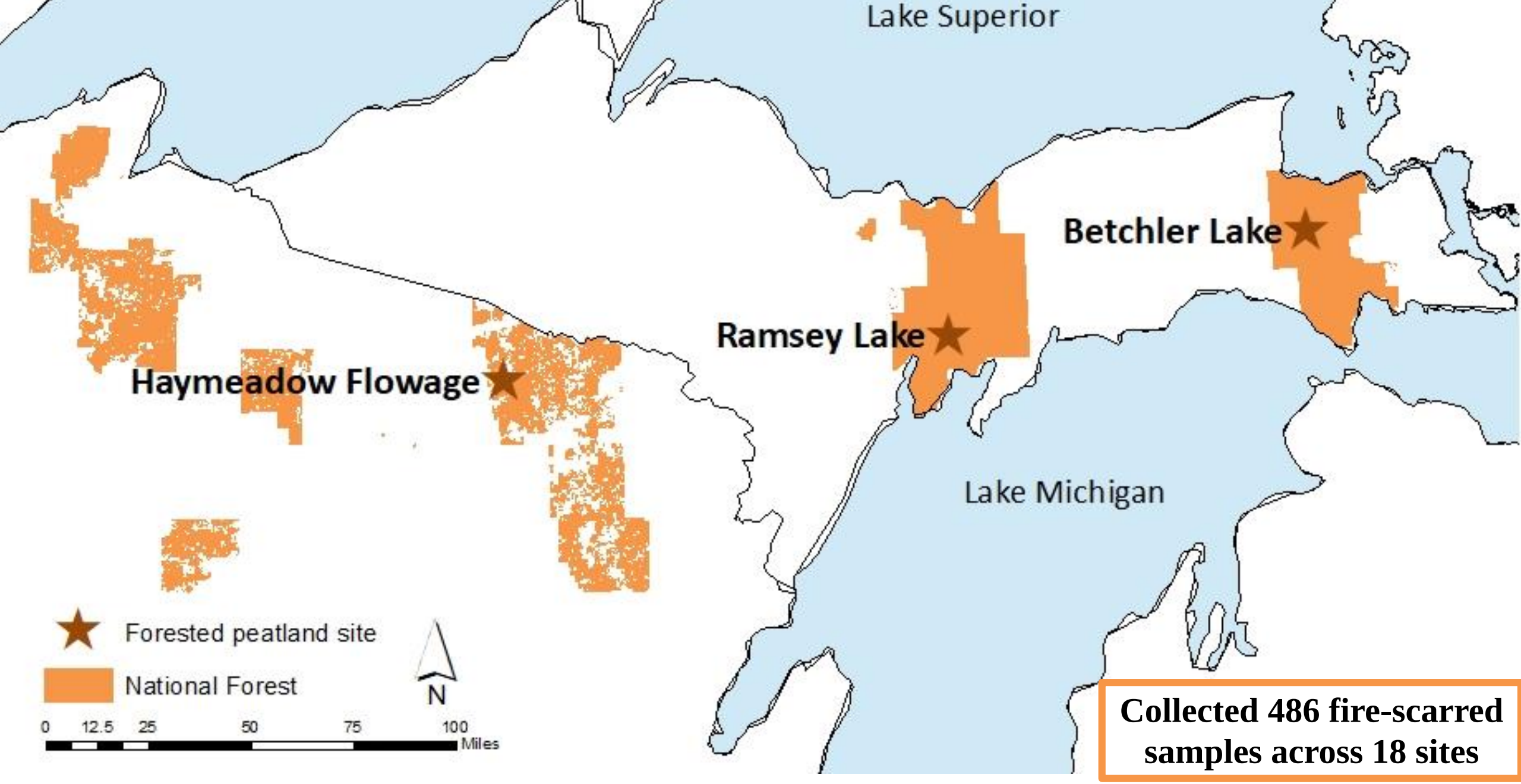
- **Reconstruct fire history of peatland ecosystems (primarily northern poor fens)**
- **Determine fire regimes and mean fire return intervals for overall landscape of the upper the Great Lakes**
- **Inform regional fire management plans and fire risk assessments using regional based datasets**

Multi-proxy approach

- **Dendrochronological work (WDNR and UW-Madison)**
- **Peat sediment core analysis (Michigan Tech University)**
- **Lake sediment core analysis(WDNR and UW-Madison)**

UW-Madison awarded 20k in 2019 from national Joint Fire Science Program to add lake sediment core analyses

Work started in 2017 and is expected to be completed by 2021



Collected 486 fire-scarred samples across 18 sites

Fire-scarred stump sampling

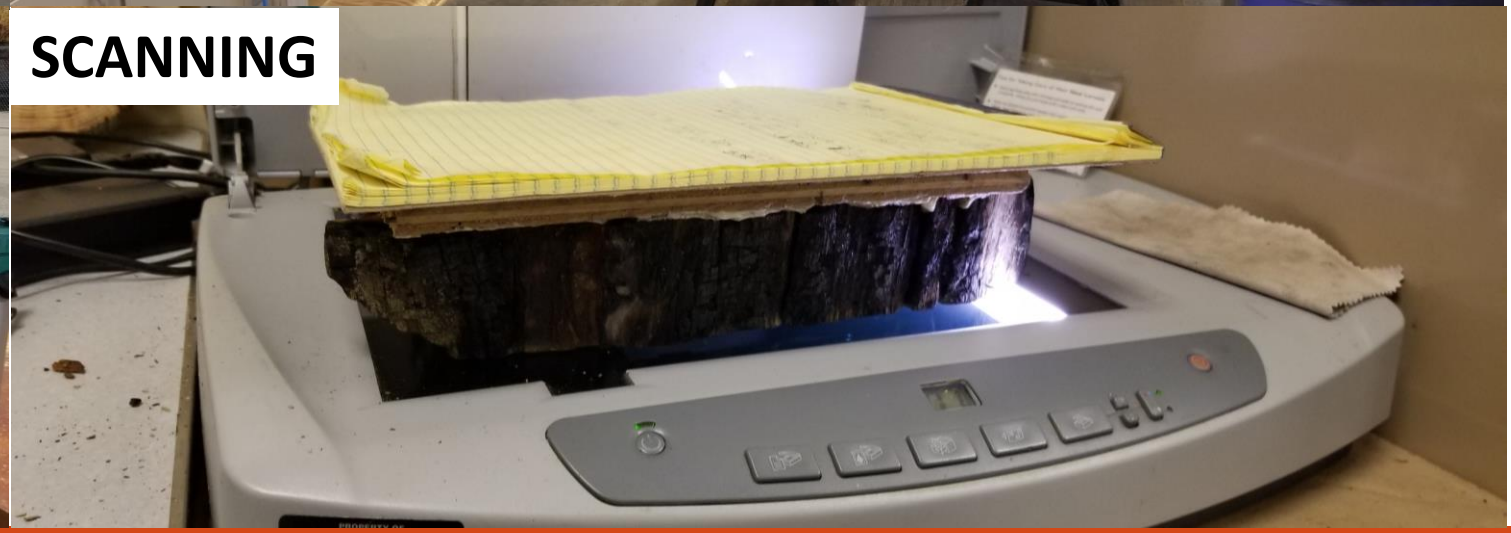
Fire-scarred sample processing

DRYING AND GLUING

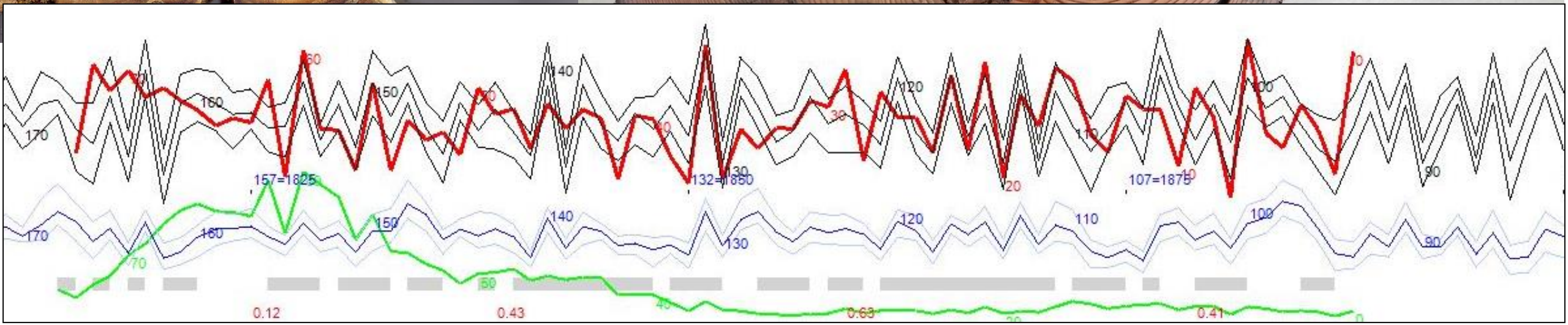
SANDING

PLANING

SCANNING



Crossdating fire-scarred tree samples

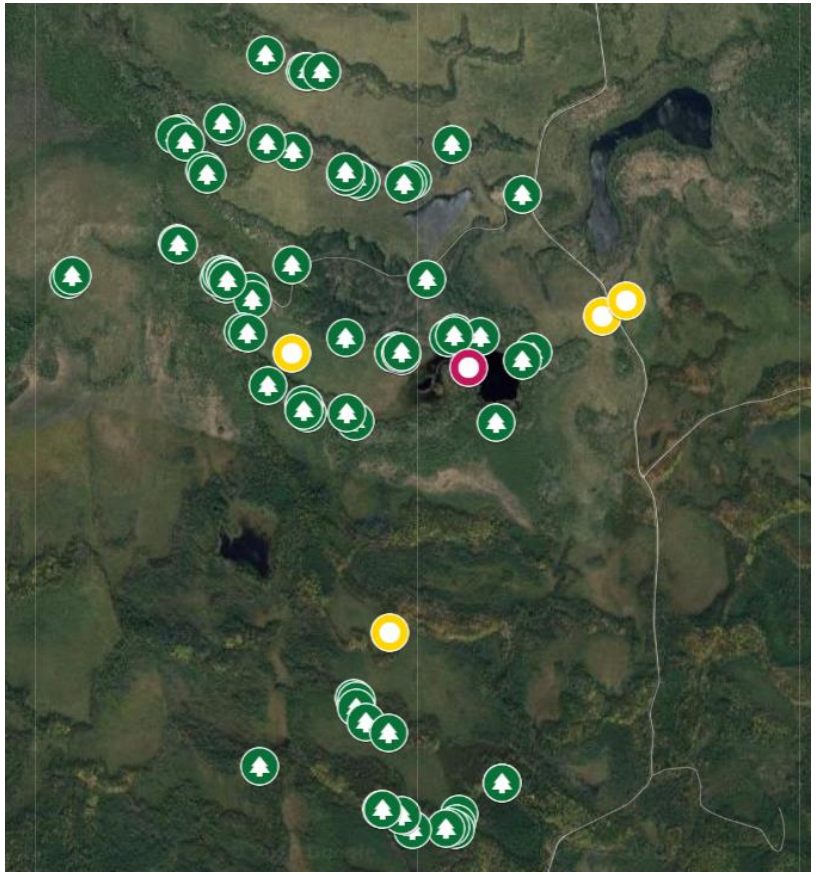


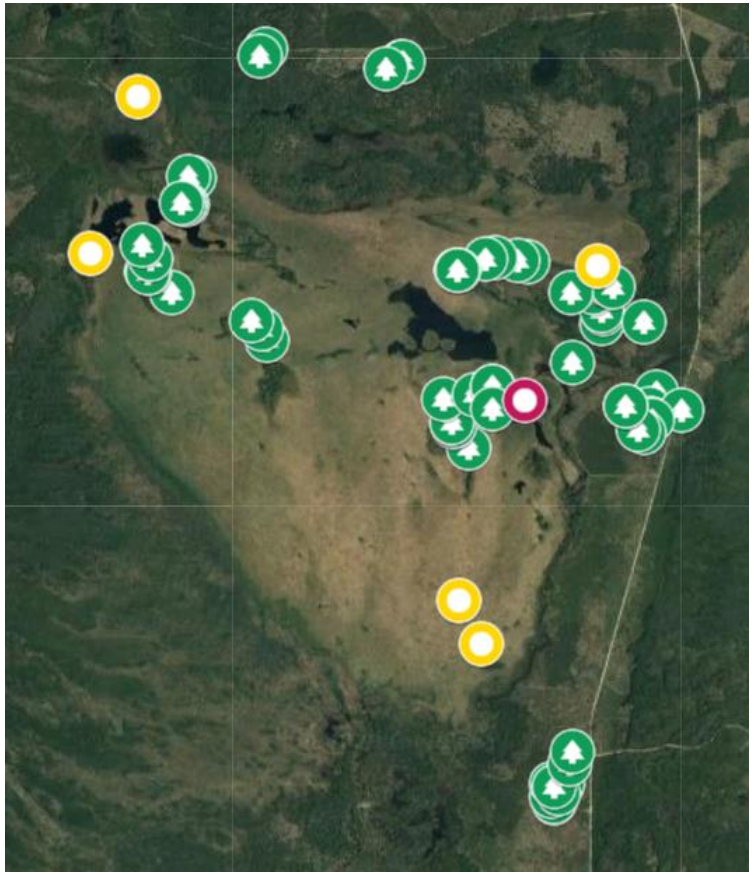
Radiocarbon dating char in cores

Peat sediment core (black layers are macro-char likely related to fire event) Photo credit Dominic Uhelski

Elizabeth Thomas, University at Buffalo

Multi-proxy Approach



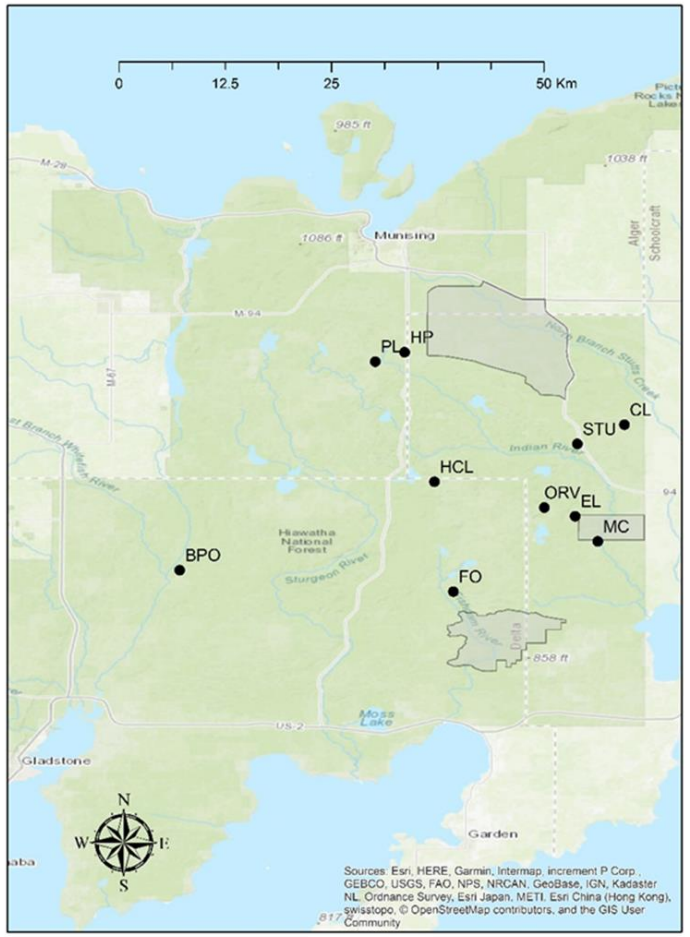


Fire-scarred tree samples
- 200 to 500-year fire history
- Annual and semiannual resolution
- Synchrony of fires across landscapes extend spatial extent
- Captures low and moderate severity fires

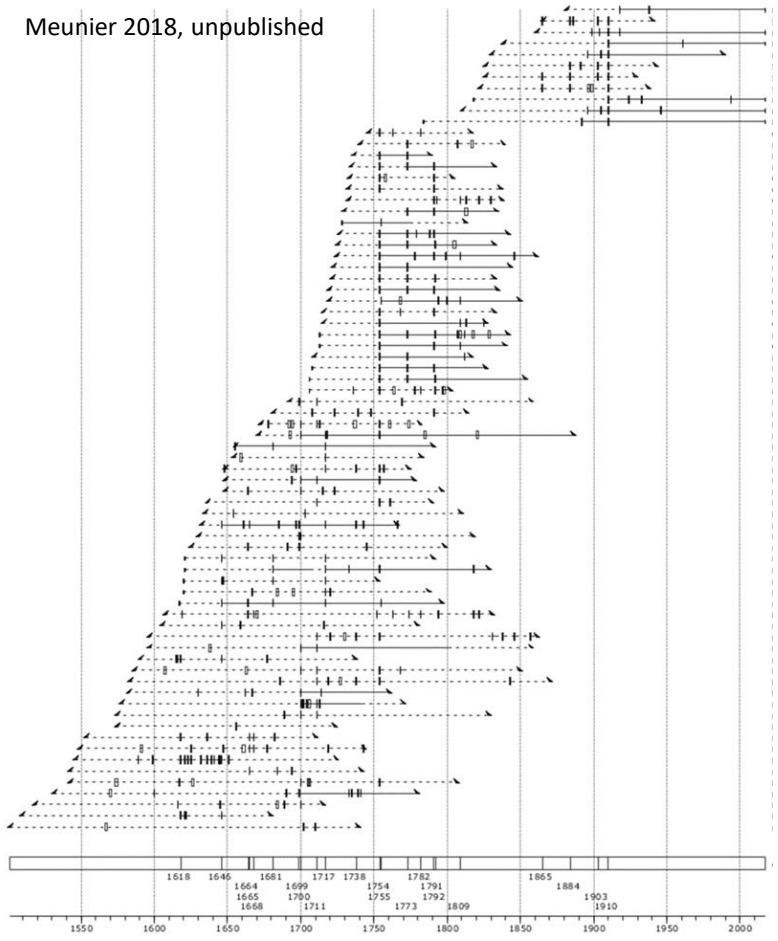
Peat sediment cores
- 500 to 1000-year fire history
- 50-year resolution
- Miss fires if peat was consumed

Lake sediment cores
- 2000 to 3000-year fire history
- Decadal resolution
- Captures high severity fires

2017 Sampling and Summary



Meunier 2018, unpublished



Captured landscape fire history in western zone of Hiawatha NF

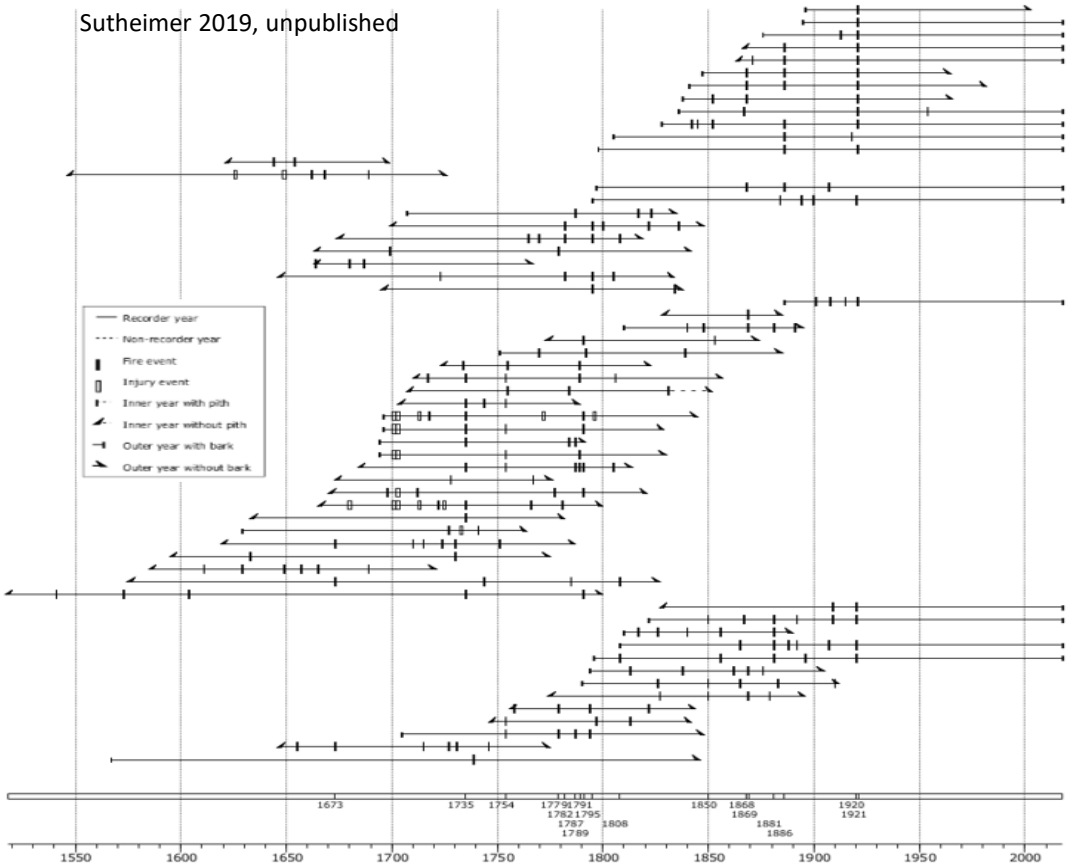
Sampled at **10 sites** collecting **127 fire-scar partial sections** across western zone of the Hiawatha

Overall chronology: 1500 to 2017

Major Fire Years (synchronous fire identified at majority of all sites sampled): 1755, 1791, and 1910

MNFI across all sites 13 years

2018 Sampling and Summary



Landscape level sampling in the eastern zone of the Hiawatha

Collected **135 samples** across 4 sites

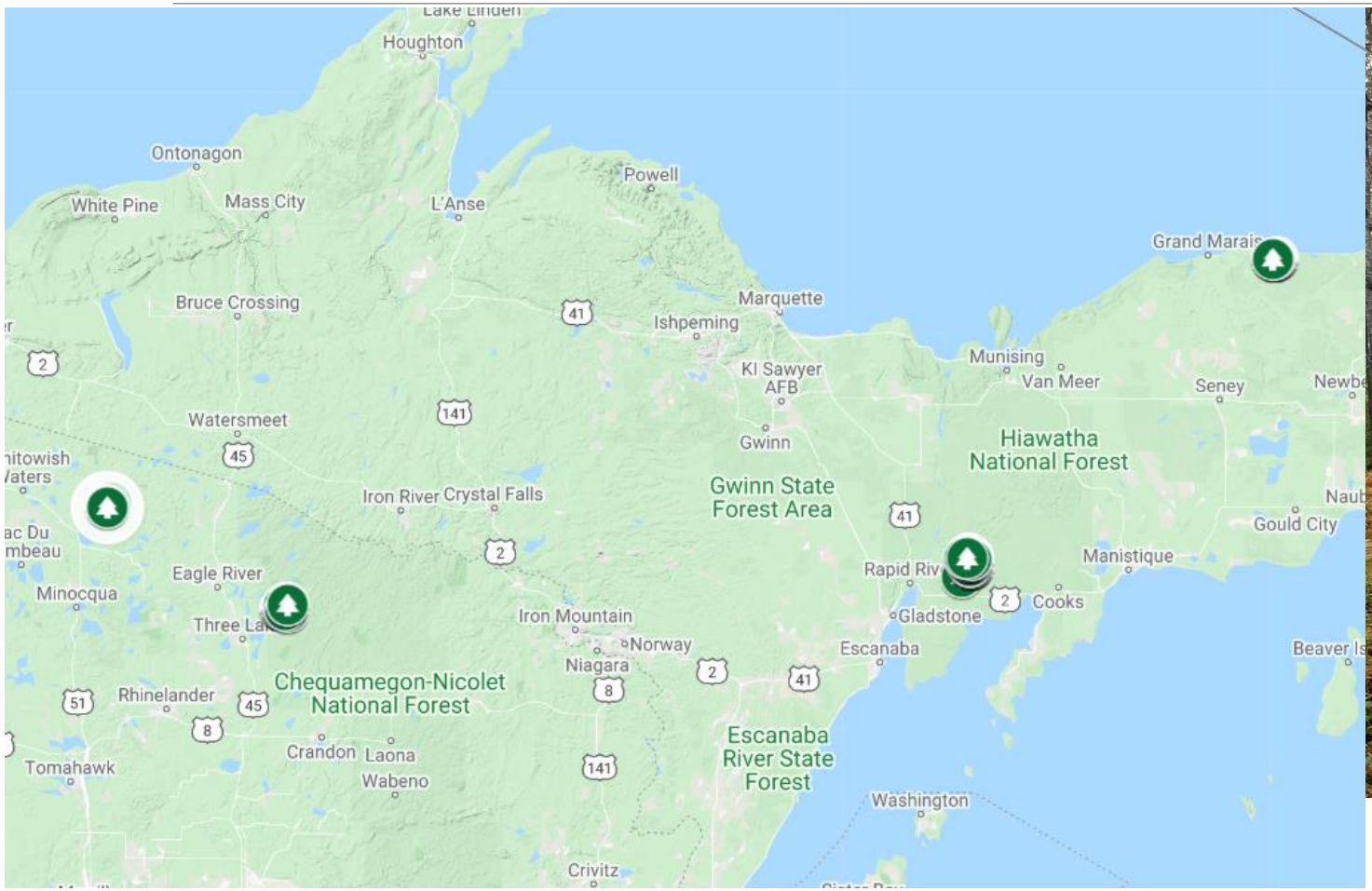
MTU collected peat cores in both zones of the Hiawatha

Overall chronology: 1518 to 2017

Major Fire Years: 1755, 1791, and 1910

MNFI across all sites was 16 years

2019 Sampling



Fire-scarred snag with 6 fire scars and remnant living PIRE with 3+ fire scars at Ramsey Lake site

2019 Summary

Total of **224 samples** across 4 sites

Ramsey Lake in Hiawatha NF

- Samples with 3 to 6 fire scars
- Steepest ridges with minimal management had best preserved samples
- 150+ year stand of red pine all with multiple fire scars

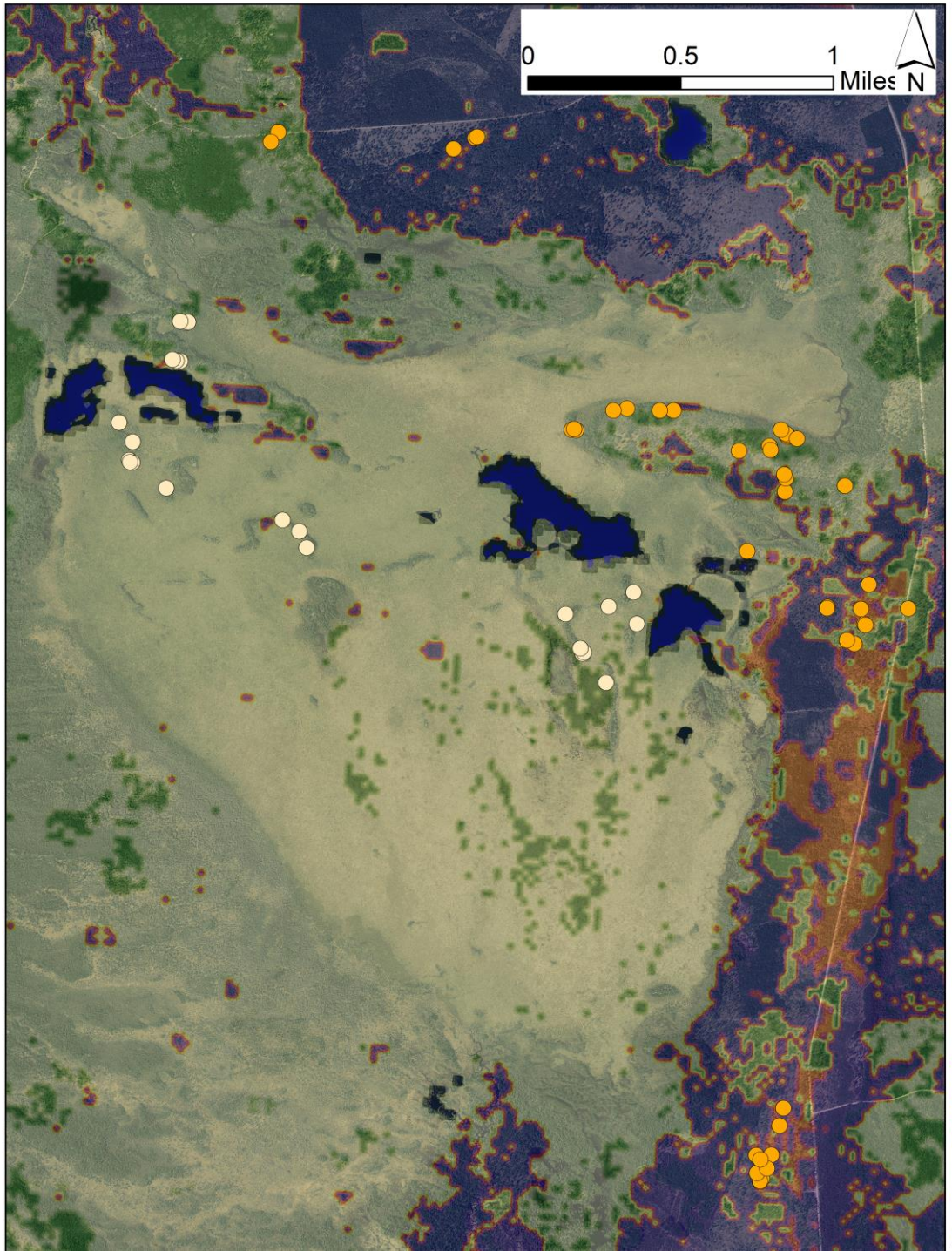
Haymeadow Flowage in Chequamegon Nicolet NF

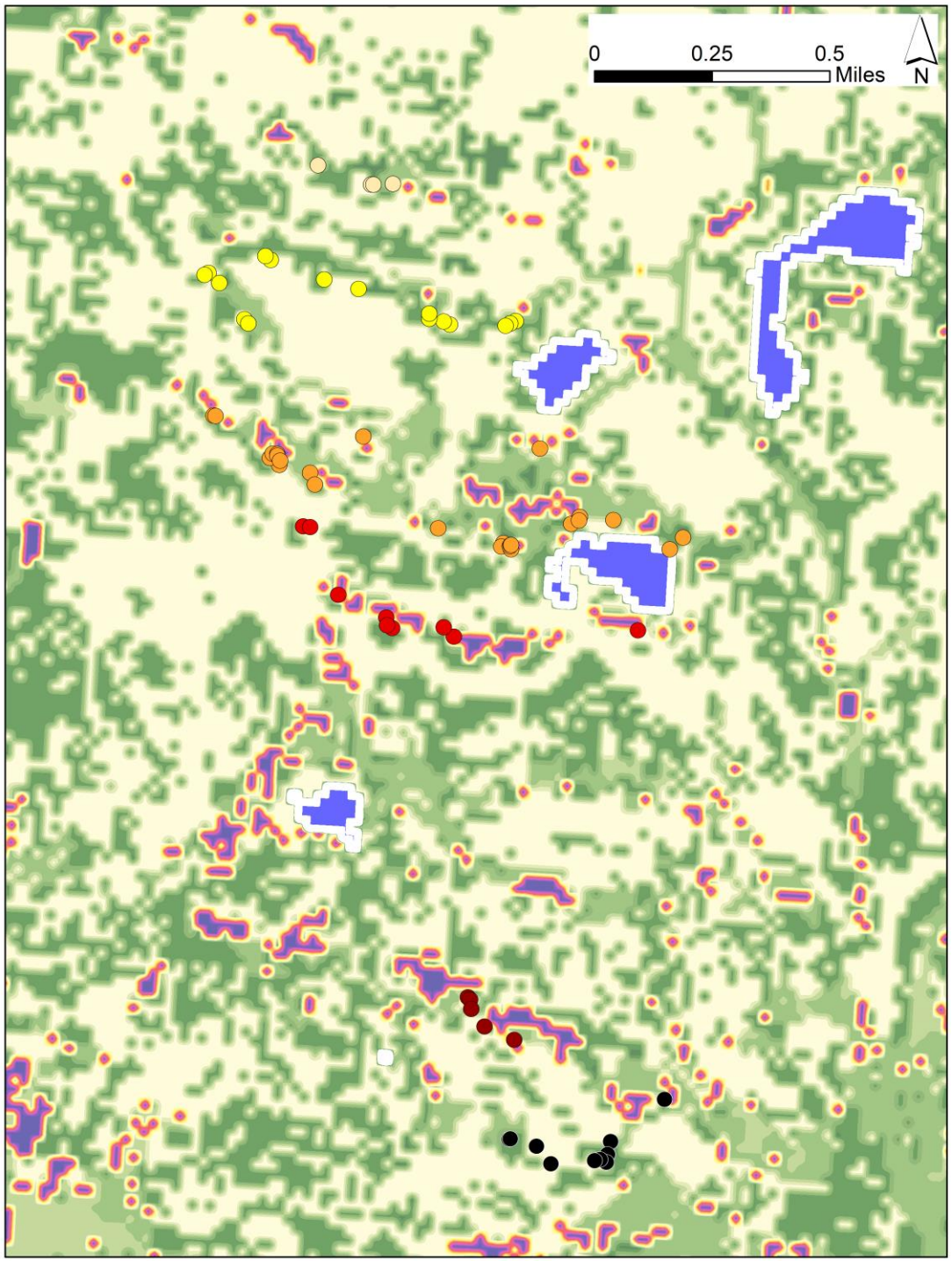
- Samples with 2 to 4 fire scars
- Catface of all trees on relatively flat islands face away from peatland indicating movement of fire from peatland to forested islands

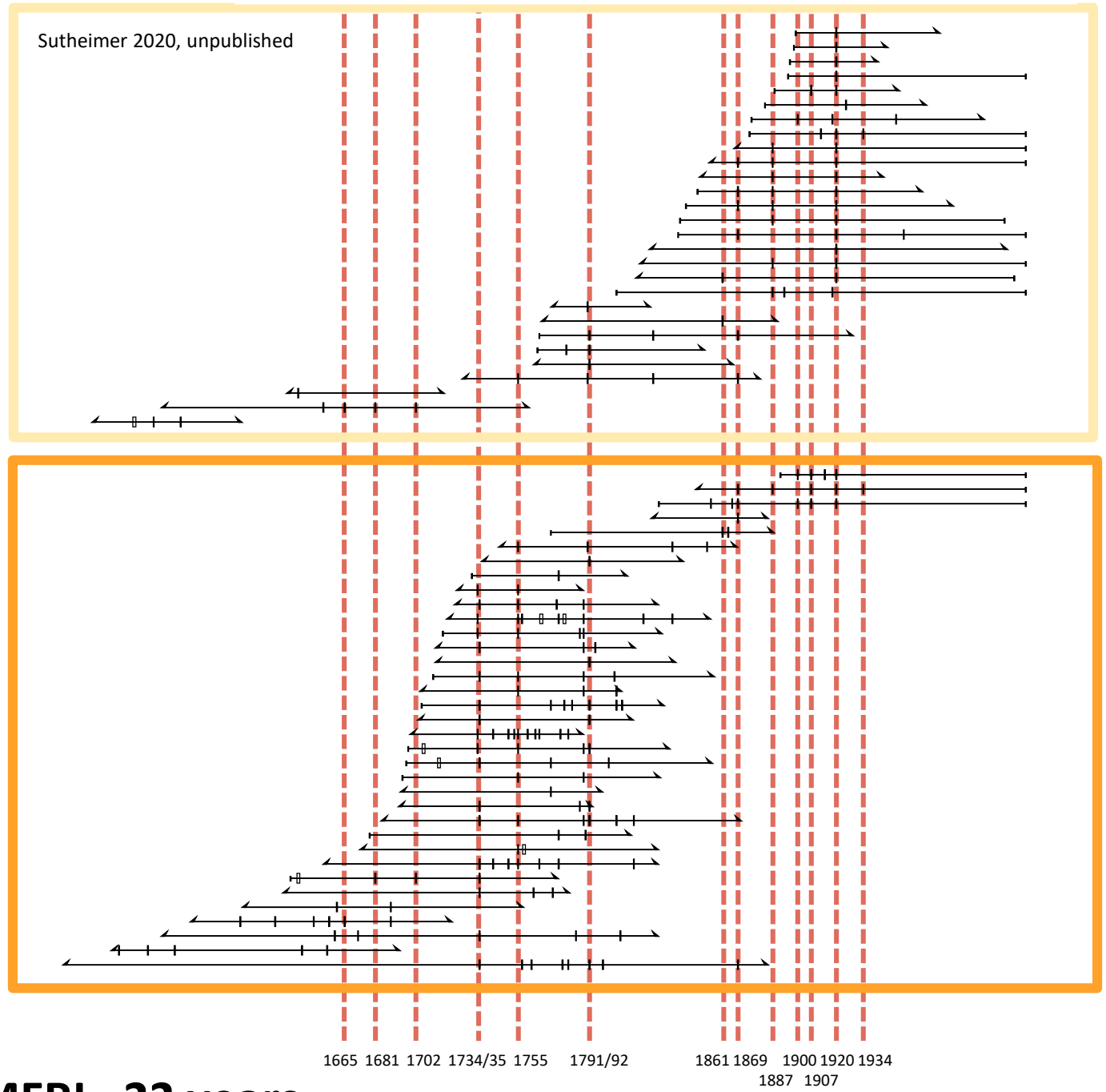
LANDFIRE MFRIs

6 to 50 years for forested islands, ridges, and surrounding uplands

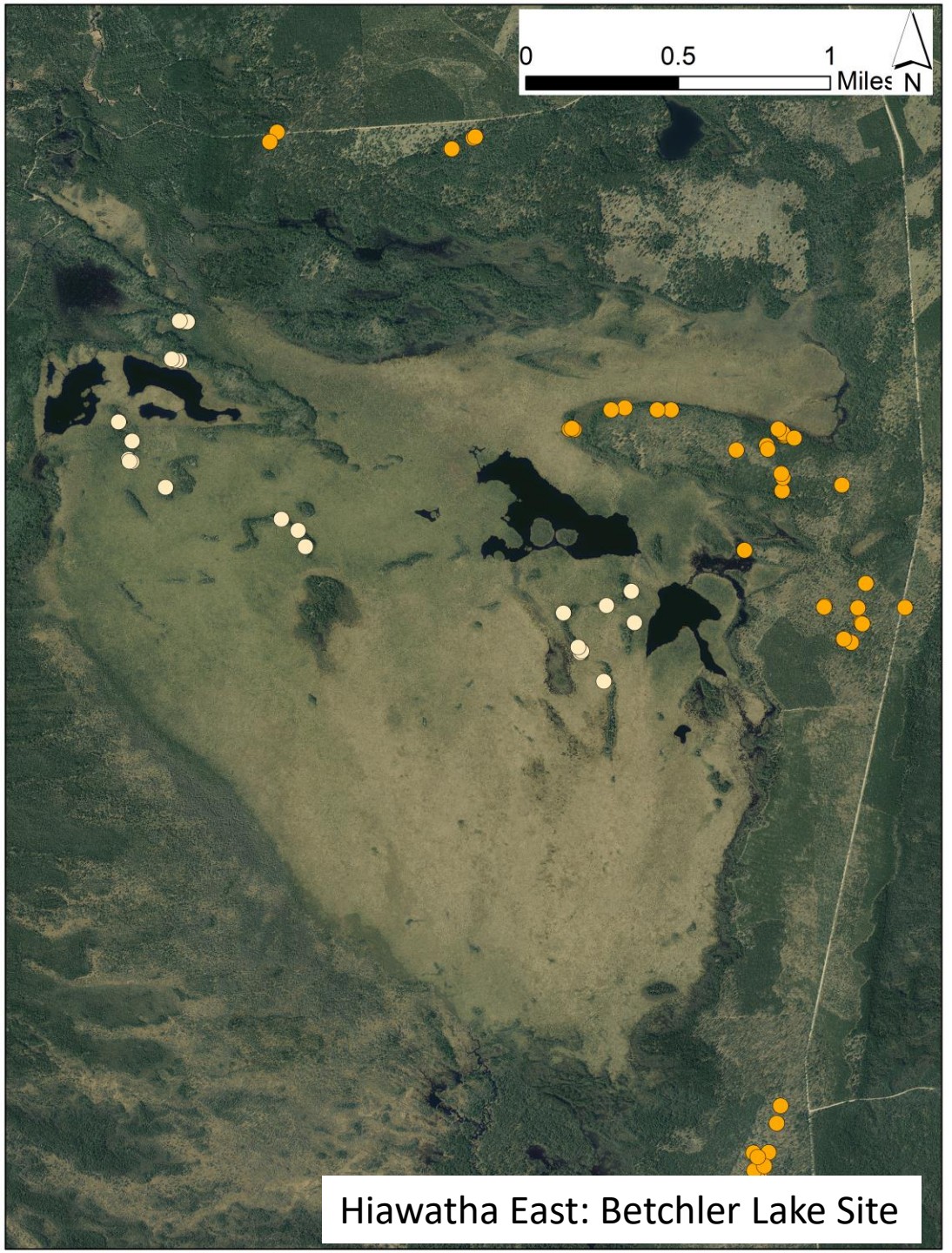
200 to 1000 years for peatland



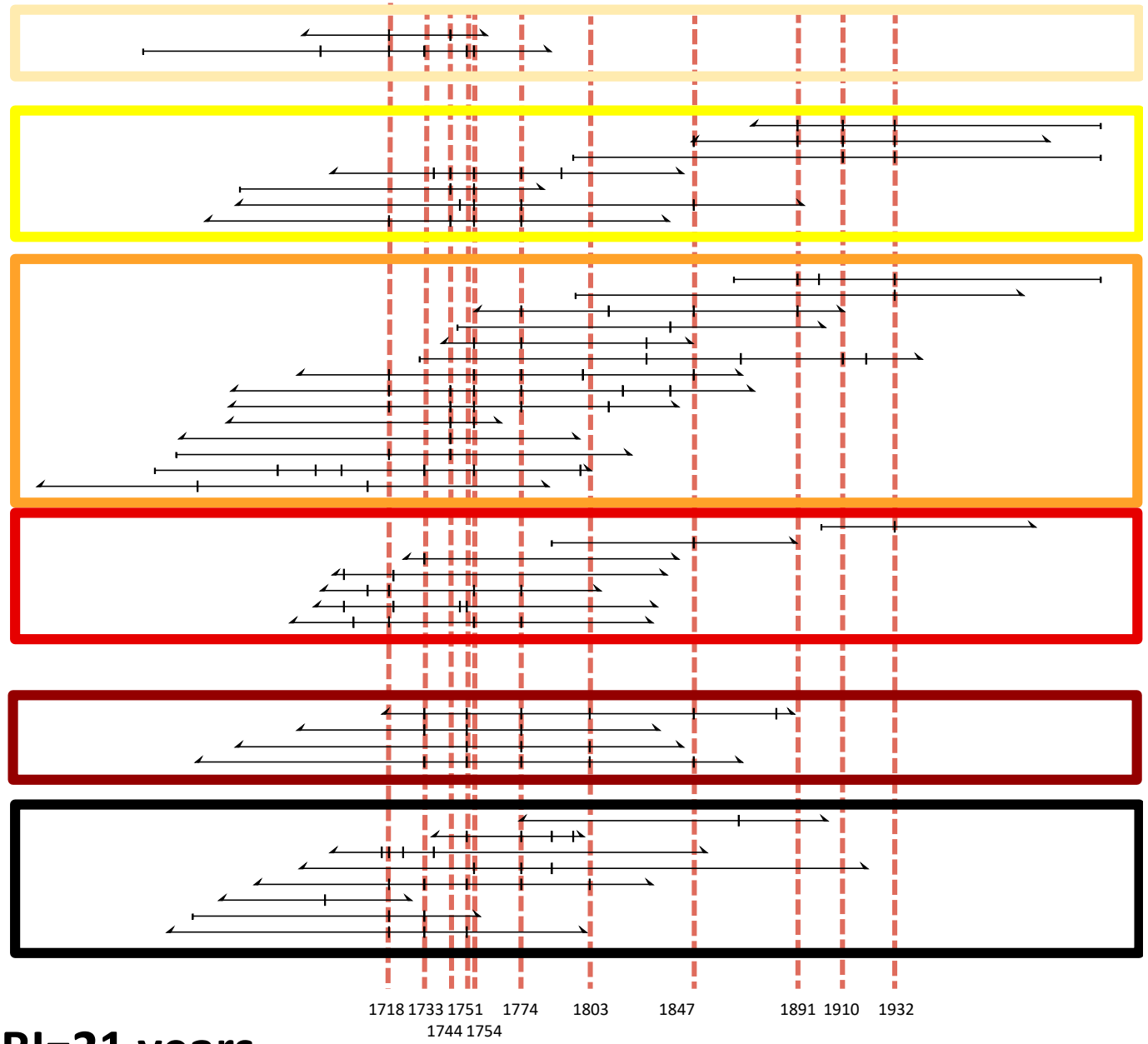




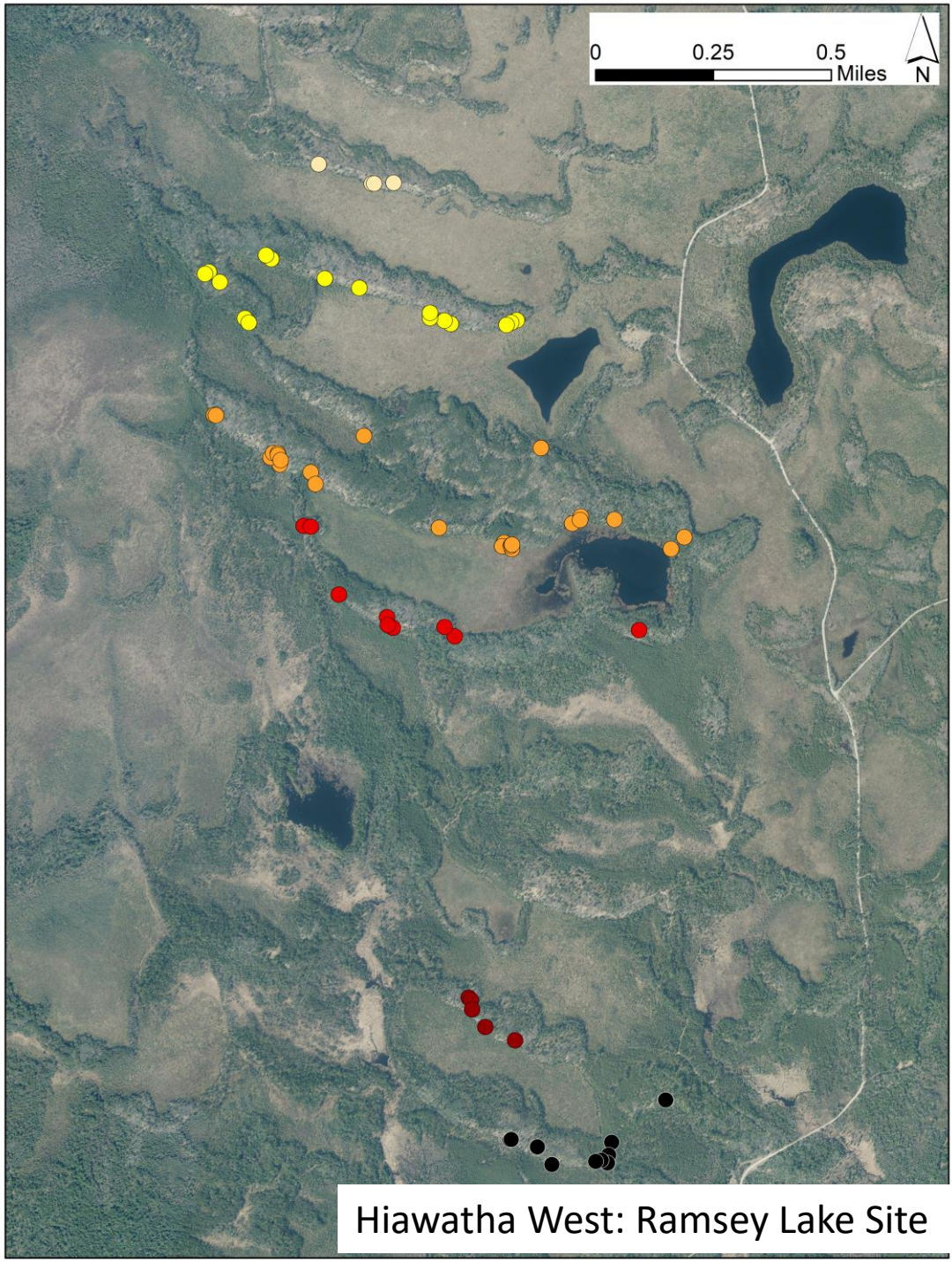
MFRI= 22 years



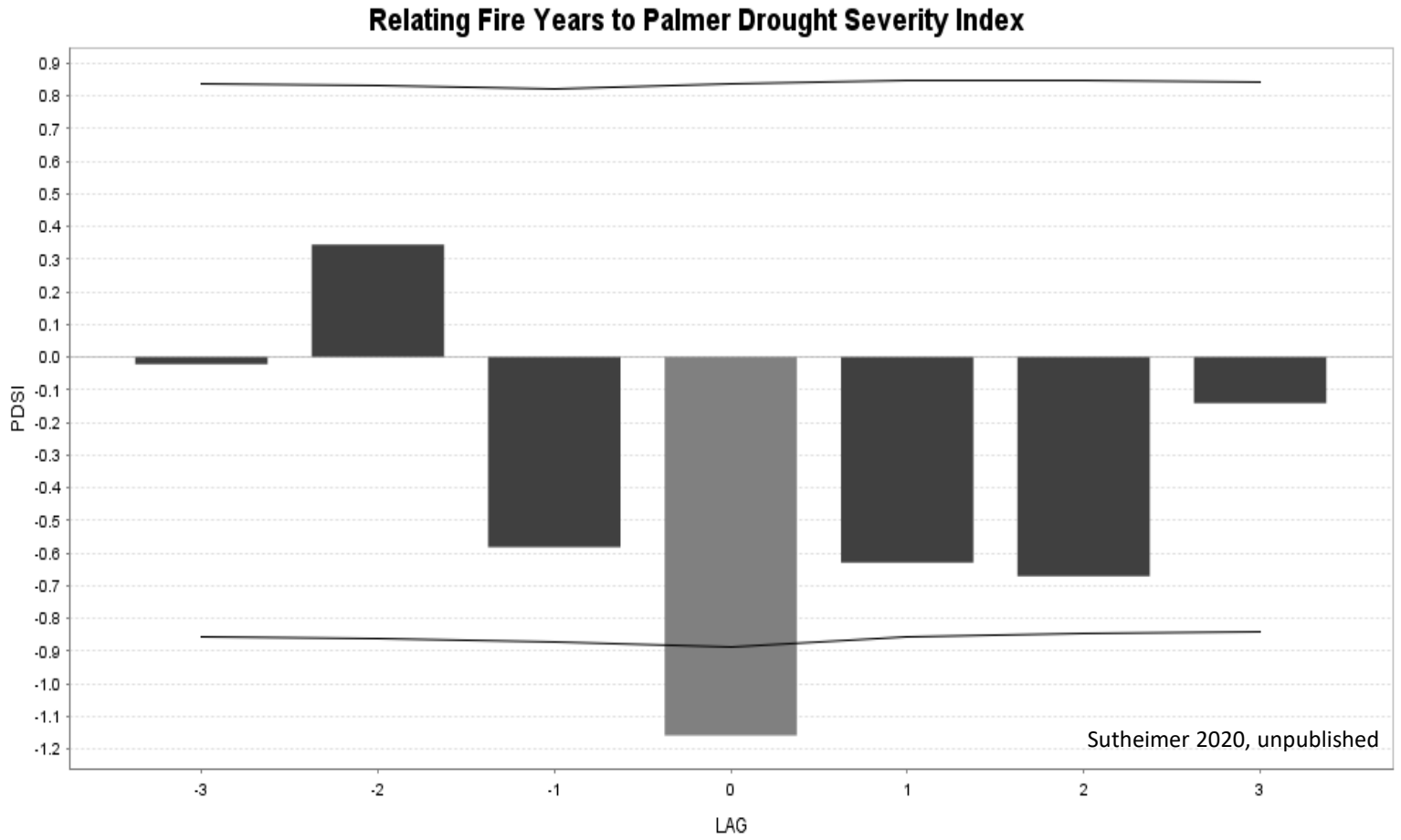
Sutheimer 2020, unpublished



MFRI=21 years



Climate-fire interactions



Superposed epoch analysis (SEA) comparing a measure of drought (Palmer Drought Severity Index) in fire years (0), years prior (-1 to -3), and after (1-3) synchronous fire years at Betchler Lake. Fire years (LAG=0) were relatively dry (95% CI).

Initial conclusions

Frequent low to moderate severity fire historically evident in peatland-forest matrices

Fire more frequent than current metrics (LANDFIRE, GLO based models) estimate for all landscapes sampled . . .major fire management implications

Absence of fire may impact peatland-forest matrices resulting in homogenized systems dominated by encroaching and undesirable species

Evidence that historic fire in peatland-forest matrices originated in peatland fuels and spread to forested islands and ridges

Understanding mixed severity disturbance at varying spatial and temporal scales through a multiproxy approach will better inform fire and forest management

Synchronous fire years like 1755, 1791, and 1910 indicate landscape level fire events across the entire upper Great Lakes region

Incidence of back-to-back fire years (1754LW/1755D or 1791LW/1792D) needs further scrutiny to determine if conventions for assigning seasonality need to be reassessed or if they are an indication of fires burning through winter

Hiawatha National Forest-USFS

Future Work

February 2020: Complete lake sediment coring at Ramsey Lake site and Betchler Lake site

Spring 2020: Complete crossdating of 2019 samples and produce USFS report on findings

Summer and Fall 2020: Dendrochronological analyses of peatland sites and completion of thesis

Fall 2020: Sample in Sturgeon River Wilderness and Ottawa NF

Fall 2021: Submit final results of multiproxy analyses to JFSP

Acknowledgements

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LANDFIRE

The Nature Conservancy: Randy Swaty

Questions